

Benefits of industrial safety in productivity

Verónica Flores Sánchez¹, Angel Adolfo Rodriguez Calvo², Jesús Juárez Borbonio³, Patricia Lyssett Bellato Gil⁴

¹Department of IMI, Universidad Tecnológica del Centro de Veracruz, Veracruz, México
Email: calidad.utcv@gmail.com

²Department of IMI, Universidad Tecnológica del Centro de Veracruz, Veracruz, México
Email: 4928@utcv.edu.mx

³Department of ER, Universidad Tecnológica del Centro de Veracruz, Veracruz, México
Email: jesus.juarez@utcv.edu.mx

⁴Department of DNM, Universidad Tecnológica del Centro de Veracruz, Veracruz, México
Email: lyssett.bellato@utcv.edu.mx

Abstract— *The risk analysis was carried out in a company dedicated to construction. In the first phase of the project, a diagnosis of the risks was made in which it was found, 30.3% of the works are performed in height, 15.8% of the activities carried out have the risk of falling materials, in the same way there was a risk of not use personal protective equipment and some psycho-physical factors.*

The company must comply with the Mexican standards that apply and reduce the risks according to the degree of danger.

Keywords— *Risk, efficiently, personal protective equipment.*

I. INTRODUCTION

The relationship between health, illness and work is initially considered as a phenomenon with unique causes (physical risk factors, chemicals, etc.) and specific effects (work risks), reducing the problem to a single causal explanation where a danger can produce a disease, for which the identification and assessment of risk factors is taken as a starting point with the purpose of quantitatively estimating the magnitude of the problem in the face of exposure.

Therefore, the appropriate intervention to work in the prevention of occupational accidents and diseases should be carried out systematically.

Success in risk management is based on developing the culture of risk prevention in the organization, where prevention must be an inherent value of organizational management at all levels (Marín A., Félix P. 2006).

The foregoing indicates that the company that companies must manage their risks from a strategic, tactical and operational perspective.

Consequently, all those responsible for the organization must have risk prevention methods to apply them in their due level of responsibility. Managers should monitor

strategic risks, managers and supervisors should reduce tactical risks, and process owners should ensure that operational risks are less and less (Cortez, J. 2007).

Labor productivity is the indicator of efficiency for the relationship between the product obtained and the amount of labor inputs invested during its production, this can be represented in the work hours necessary to obtain a product or service.

Therefore, any implication in the work hours in a negative way influences the same tendency on labor productivity, so a systematic work to eliminate factors generated by accidents and occupational diseases contributes significantly in productivity at the organizational level.

The case study company performs maintenance and repair of machinery and equipment, offers installation and modification of structures, repairs industrial machinery and electrical installations. Similarly remodels and paints work areas.

Due to the nature of the services, there are frequent levels of risk in heights, handling of toxic products, burns, among others.

Objectives

Develop procedures for the prevention of accidents or occupational diseases in order to preserve the life, health and physical integrity of workers in order to increase productivity levels.

Specific objectives

- Identify the risk factors that exist in the maintenance area of the company, case study.
- Analyze the impact of the application of safety standards in the area of maintenance on the productivity of the same area.

The implementation of safety programs in the workplace is important to prevent occupational hazards that may cause damage to the worker. The physical and mental integrity of the worker is more important than indices of production,

the foregoing indicates that the more dangerous a work activity is, the greater the care and precautions must be when carrying it out; consequently the prevention of accidents and efficient production go hand in hand.

It is important to emphasize that the implementation of security programs bring benefits to the employer and the employee.

Benefits for the employer:

- 1) Decrease in costs due to work accidents.
- 2) High production levels for incentives granted to the employee with zero accidents.
- 3) Better work environment
- 4) Benefits for the employee:
- 5) Reduction of accident risks within the work area.
- 6) Better quality of life for the employee and his family.
- 7) Increased life expectancy by reducing risks to the employee's health.

II. RESEARCH PROPOSAL

Firstly, the risks and unsafe conditions existing within the company must be determined and known.

The above taking as reference the official Mexican standards issued by the Ministry of Labor and Social Security and that determine the minimum conditions necessary for the prevention of work risks and are characterized by the fact that they are used to attend to risk factors, to which The workers can be exposed.

In Mexico, occupational safety and health is regulated by various precepts contained in the Political Constitution, the Organic Law of the Federal Public Administration, the Federal Labor Law, the Federal Law on Metrology and Normalization, the Federal Regulation of Safety and Health in the Workplace, as well as by the official Mexican standards of the subject, among other ordinances ("Normas Oficiales Mexicanas de Seguridad y Salud en el Trabajo", 2018).

Following are the 41 official Mexican standards on occupational safety and health. These standards are grouped into five categories: safety, health, organization, specific and product. Its application is mandatory throughout the national territory ("Normas Oficiales Mexicanas de Seguridad y Salud en el Trabajo", 2018).

Safety rules:

1. NOM-001-STPS-2008 Buildings, premises and facilities
2. NOM-002-STPS-2010 Prevention and protection against fire
3. NOM-004-STPS-1999 Systems and safety devices in machinery
4. NOM-005-STPS-1998 Handling, transport and storage of dangerous substances

5. NOM-006-STPS-2014 Handling and storage of materials
6. NOM-009-STPS-2011 Works at height
7. NOM-020-STPS-2011 Containers subject to pressure and boilers
8. NOM-022-STPS-2008 Static electricity
9. NOM-022-STPS-2015 Static electricity
10. NOM-027-STPS-2008 Welding and cutting
11. NOM-029-STPS-2011 Maintenance of electrical installations
12. NOM-033-STPS-2015 Works in confined spaces
13. NOM-034-STPS-2016 Access and development of activities for workers with disabilities.

Health Standards:

1. NOM-010-STPS-1999 Contaminants by chemical substances
2. NOM-011-STPS-2001 Noise
3. NOM-012-STPS-2012 Ionizing radiation
4. NOM-013-STPS-1993 Non-ionizing radiation
5. NOM-014-STPS-2000 Abnormal environmental pressures
6. NOM-015-STPS-2001 High or depleted thermal conditions
7. NOM-024-STPS-2001 Vibrations
8. NOM-025-STPS-2008 Lighting

Organization Rules:

1. NOM-017-STPS-2008 Personal protective equipment
2. NOM-018-STPS-2000 Identification of hazards and risks by chemical substances
3. NOM-019-STPS-2011 Safety and hygiene commissions
4. NOM-026-STPS-2008 Colors and safety signs
5. NOM-028-STPS-2012 Safety in processes and equipment with chemical substances
6. NOM-030-STPS-2009 Preventive health and safety services

Specific Rules:

1. NOM-003-STPS-1999 Pesticides and fertilizers
2. NOM-007-STPS-2000 Installations, machinery, equipment and agricultural tools
3. NOM-008-STPS-2001 Timber exploitation and sawmills
4. NOM-008-STPS-2013 Timber forest exploitation
5. NOM-016-STPS-2001 Operation and maintenance of railways
6. NOM-023-STPS-2012 Works in underground and open pit mines
7. NOM-031-STPS-2011 Construction

8. NOM-032-STPS-2008 Underground coal mines

The first three categories (safety, health and organization) are compulsory in the work centers that carry out production, commercialization, transport and storage activities or services, depending on the characteristics of the activities they develop and the raw materials, products and by-products that they are handled, transported, processed or stored. For the fourth category, its mandatory application is envisaged in the companies that belong to the specific sectors or activities to which these standards refer. Finally, the fifth category corresponds to the companies that manufacture, market or distribute fire protection and personal protection equipment ("Normas Oficiales Mexicanas de Seguridad y Salud en el Trabajo", 2018).

This document identifies and assesses the importance of existing risks for occupational safety and health in the case study.

In the first phase of the study, the characteristics of work activities and jobs are identified.

Subsequently, the potential risks are identified and evaluated. The criteria for assessing risk are described in figures 1 and 2.

Accident probability	P
VERY HIGH - It is very likely to occur immediately	5
HIGH - It is likely to occur in a short period of time	4
MODERATE - It is likely to occur in the medium term	3
LOW - It is possible that it will be produced	2
VERY LOW - It is unlikely that it will produce	1

Fig. 1: Probability of the accident occurring

Severity of the consequences	C
VERY HIGH - May cause death or severe disability	5
HIGH - May cause significant invalidating injuries	4
MODERATE - May cause non-disabling injuries	3
LOW - Can cause small injuries with low	2
VERY LOW - Can cause small injuries without loss	1

Fig. 2: Severity of the consequences

Finally, the degree of danger is calculated by multiplying the values shown in Figure 1 and 2.

III. RESULTS

During the tour of the company the following risks were found:

1. Risk of work at height
2. Risk of falling materials
3. Risk of installation of work equipment
4. Risk of handling tools and equipment
5. Risk related to the order and cleanliness
6. Psycho-occupational risks
7. Risks of non-use of personal protective equipment

The most frequent accidents were: fall of height

1. Cuts
2. Punctures
3. Bone fracture
4. Hit by falling objects

Due to the above, the rules that should be followed can be seen in the following list:

1. NOM-001-SEDE-2012 Electrical installations
2. NOM-001-STPS-2008 Buildings, premises and facilities
3. NOM-002-STPS-2010 Prevention and protection against fires
4. NOM-004-STPS-1999 Systems and safety devices in machinery
5. NOM-005-STPS-1998 Handling, transport and storage of dangerous substances
6. NOM-006-STPS-2014 Handling and storage of materials
7. NOM-009-STPS-2011 Work at height
8. NOM-020-STPS-1994 Medicines, healing materials and personnel providing first aid
9. NOM-022-STPS-2008 Static electricity
10. NOM-027-STPS-2008 Welding and cutting
11. NOM-029-STPS-2011 Maintenance of electrical installations
12. NOM-033-STPS-2015 Work in confined spaces
13. NOM-010-STPS-1999 Contaminants by chemical substances
14. NOM-011-STPS-2001 Noise
15. NOM-025-STPS-2008 Lighting
16. NOM-017-STPS-2008 Personal protective equipment
17. NOM-018-STPS-2000 Identification of hazards and risks by chemical substances
18. NOM-019-STPS-2011 Safety and hygiene commissions
19. NOM-026-STPS-2008 Colors and safety signs
20. NOM-030-STPS-2009 Preventive health and safety services

21. NOM-011-STPS-2001 Conditions of safety and hygiene in workplaces where noise is generated
22. NOM-015-STPS-1994 Personal protection for workers in workplaces

IV. CONCLUSION

Risk	P	C	GP
Risk of work at height	5	3	15
Risk of falling materials	4	4	16
Risk of installation of work equipment	5	5	25
Risk of handling tools and equipment	4	4	16
Risk related to the order and cleanliness	5	4	20
Psycho-occupational risks	3	3	9
Risks of non-use of personal protective equipment	5	4	20

Fig. 3: Degree of risk hazard (GP)

According to figure 3 it can be concluded that:

- 1) The risk of work at height is MODERATE. It needs to be corrected quickly (<1 week).
- 2) The risk of falling materials is HIGH. It needs to be corrected immediately (<1 day).
- 3) The risk of installation of work equipment is VERY HIGH. It is necessary to paralyze activity and jobs.
- 4) The risk of handling tools and equipment is HIGH. It needs to be corrected immediately (<1 day).
- 5) The risk related to the order and cleanliness VERY HIGH. It is necessary to paralyze activity and jobs.
- 6) The psycho-occupational risks LOW. It needs to be corrected as soon as possible (<1 month).
- 7) The risks of non-use of personal protective equipment, is VERY HIGH. It is necessary to paralyze activity and jobs.

REFERENCES

- [1] Cortez, J. (2007). Seguridad e higiene del trabajo. España. Editorial Tebar.
- [2] Díaz, A., Gallego, A., Márquez, A., Millán, A., Moreno, J., Fernández, R.,... Viñas, J. (2008). Manual para la formación en prevención de riesgos laborales. España: Editorial Lex Nova.
- [3] Marín A., Félix P. (2006). Seguridad Industrial, Manual para la formación de ingenieros. España. Editorial Dykinson, S.L.
- [4] Ramírez, C. (2005). Seguridad Industrial: Un enfoque integral. México: Editorial Limusa.

- [5] Méndez, Alejandro; Roberto Juárez. (2002) Investigación de Operaciones. México. Mc Graw Hill.
- [6] Normas Oficiales Mexicanas de Seguridad y Salud en el Trabajo. (2018). Retrieved from <http://asinom.stps.gob.mx:8145/Centro/CentroMarcoNormativo.aspx>
- [7] Rodríguez, J. (2002). Cómo elaborar y utilizar los manuales administrativos. México. International Thomson Editores, S. A. de C. V.
- [8] Vaughn, R. C. (1988). Introducción a la ingeniería industrial. España: Editorial Reverté, S. A.